

(1) If only an approximate azimuth is required, the best means of determining it is by fixing the direction of the sun or a star when it has the greatest altitude. This direction, of course, defines the astronomical meridian, as all heavenly bodies cross it when they are at their greatest altitude.

By using stars of both high and low altitudes a greater exactness can be obtained, but, after all, the method only gives a first approximation, as its weakness lies in the very slow change of altitude as the meridian is approached.

(2) A much more accurate method is that of observing the azimuth of a star when at the same altitude east and west of the meridian. If the mean of the two readings given by the azimuth circle be taken, the resulting reading indicates the direction of the meridian.

(3) To find the meridian line by means of the pole

importance, for in such work, if accuracy is required, as it should be, one setting and one reading are of little use.

NORMAN LOCKYER.

THE HORNED DINOSAURS.¹

FROM time to time mention has been made in the columns of NATURE of contributions to our knowledge of what are perhaps the most wonderful members of a wonderful order, namely, the horned dinosaurs, or Ceratopsia, of the American Upper Cretaceous, the last of such notices relating to Mr. Lull's conclusions to be drawn with regard to the cranial muscles of the typical forms from the study of the skull. In the present sumptuously illustrated volume, which has a melancholy interest as being mainly the work of an exceedingly talented and promising



Restoration of a Horned Dinosaur (Triceratops), with an Iguanodon (Trachodon) in the distance. From Hatcher's "Ceratopsia."

star is a simple and accurate method, as a value can be obtained at *any* time at night by a simple altitude, provided the time of observation is known.

Should there not be sufficient time to take the necessary observations, the true bearing of the sun and also some star can be obtained by inspection from Birdwood's azimuth tables.

If we employ the sun in place of a star, its change of declination during the interval between the observations must be taken into account.

It is not alone with regard to azimuth that the results obtained by a theodolite far surpass all others in accuracy, as all magnetic difficulties are overcome, and larger circles give us closer and more accurate readings.

In altitude observations the fact that the observing telescope can be reversed and swung round so that all sources of errors of the horizontal plane of the instrument can be eliminated is a matter of equal

palæontologist who did not live to earn the full reward of his labours, we have a full description of all that is known with regard to the osteology, relationships, and classification of these wondrous reptiles, together with notes and speculations (by Mr. Lull) regarding their distribution, phylogeny, and probable habits and environment.

In his preface Mr. Hatcher, we are glad to observe, bore testimony to what we owe to the late Prof. O. C. Marsh in the matter of our knowledge of the Ceratopsia. To a large extent his generosity "made it possible to bring together the collections upon which this volume is based. Nor did his contributions to the subject end here, for, as appears on the title-page, the present memoir was based on his preliminary studies, and although he left no manuscript aside from his

¹ "The Ceratopsia." By J. B. Hatcher. Edited and completed by R. S. Lull. Pp. xxx+300; plates i-iii. (Washington: U.S. Geol. Survey, Monograph xlix., 1907.)

published papers on the Ceratopsia, he provided a fund of information in the shape of finished and unfinished drawings."

Mr. Hatcher considered the horned dinosaurs to be probably an exclusively American group, none of the European dinosaurs tentatively placed therein having any definite claim to such a position. In the case of a Wealden bone, described as a ceratopsian horn, the opinion is expressed that it is really a much weathered ungual phalange of a member of the sauropod group.

Leaving Mr. Hatcher's osteological section, the remainder of this notice may be devoted to brief mention of some of the interesting facts and speculations brought together in Mr. Lull's supplement.

The earliest known Ceratopsia occur in the Judith River beds, but of the ancestors of these latter we have no knowledge, possibly for the reason that they were inhabitants of dry land, instead of, like their successors, frequenters of swamps. The members of the group living at the Laramie epoch exhibit advance over their predecessors in the matter of bodily size, the preponderance of the supraorbital pair of horns over the single nasal one, the fuller development of the wonderful flange-like neck-shield of the skull, and the perfection of a peculiar type of dentition. Several attempts have been made to reproduce the external form of the horned dinosaurs, the most successful, in the opinion of Mr. Lull, being a painting and a statuette by Mr. C. R. Knight of Triceratops, the former of which is copied as a frontispiece to the volume before us, and is herewith reproduced.

That the horned dinosaurs were herbivorous is perfectly manifest; and it is suggested that while the edentulous, and doubtless horny, beak served for cropping succulent leaves and shoots, the teeth in the sides of the jaws chopped the food into short fragments, as they were not adapted for mastication. Swamps seem to have been the home of these rhinoceros-like dinosaurs; and this, it is suggested, may negative the idea that they were exterminated by the attacks of small predaceous mammals, since it has been considered that the latter were arboreal. If, however, mammals are derived from the theriodont reptiles, the theory that all the early forms were arboreal seems to require reconsideration.

Be this as it may, a more probable factor leading to the wane of the Ceratopsia was "changing climatic conditions and a contracting and draining of the swamp and delta regions caused by the orographic upheavals which occurred towards the close of the Cretaceous. The Ceratopsidæ and their nearest allies, the Trachodontidæ, both highly specialised plant-feeders, were unable to adapt themselves to a profoundly changed environment because of this very specialisation, and, as a consequence, perished."

The volume reflects the highest credit on all concerned in its production, and is an admirable example of the modern style of palæontological investigation, so intrinsically different in its picturesque speculation from the long series of dry details which alone formed the contents of works of this nature published a quarter of a century ago. R. L.

NOTES.

THE death is announced of M. D. Clos, director of the Jardin des Plantes at Toulouse, and correspondent of the section of botany of the Paris Academy of Sciences.

PROF. L. H. BAILEY, of Cornell University, has accepted the chairmanship of the commission appointed by President Roosevelt to report upon the social and economic conditions of agricultural life.

A REUTER message from Berlin announces that the Academy of Sciences there has received a legacy of 30,000,000 marks (1,500,000*l.*), being the entire fortune of a millionaire named Samson, who recently died childless at Brussels.

AT Le Mans on Monday, Mr. Wilbur Wright travelled in his flying machine a distance of 48.12 kilometres in 1h. 7m. 11.4s. He afterwards performed a flight lasting 11m. 35.4s., with a passenger, at a speed of nearly one kilometre a minute.

THE Graham medal of the Royal Philosophical Society of Glasgow (awarded for original research in any branch of chemical science) is now open to competition. All information respecting the conditions of the award may be obtained from the secretary of the society.

THE quinquennial Riberi prize, of the value of 800*l.*, according to the *Athenæum*, has been awarded by the Academy of Turin to Prof. Bosco, of Turin, for his discovery of biological reaction, *i.e.* of a peculiar growth of mould on substances containing arsenic, tellurium, or selenium.

THE eighth International Congress of Hydrology, Climatology, Geology, and Physical Therapeutics is to be held at Algiers on April 4 to 10 next. All papers to be read at the meeting should be sent by, at latest, January 31. Full particulars of the congress can be obtained from M. Raynaud, 7 Place de la République, Algiers.

DR. SVEN HEDIN, in delivering a private lecture at Simla on his discoveries in Tibet, stated that although little is left in that country in the way of geographical discovery, in geology much remains to be done. Dr. Hedin is of opinion that from two to three years will be required to work up the mass of information collected by him relating to tracts hitherto unknown to Europeans.

THE Dove Marine Laboratory at Cullercoats was opened on Tuesday by the Duke of Northumberland. A polished granite tablet near the entrance bears the inscription:—"Erected A.D. 1908 by Wilfred H. Hudleston, M.A., F.R.S., for the furtherance of Marine Biology and as a Memorial of his Ancestress Eleanor Dove." The new building, which stands on the site of the old baths, contains an aquarium 30 feet by 23 feet, and there are eleven fish tanks. There is also a private aquarium, and provision is made in thirty-six tanks for the storing of materials for experimental work. A concrete tank holding 15,000 gallons of salt water will give a continual flow through the various tanks. The laboratory is in connection with Armstrong College, Newcastle-on-Tyne.

A RETURN issued by the Government of India shows that the total mortality amongst human beings reported to be due to snake-bite was 21,419 in 1907. The treatment of snake-bite by incision and application of permanganate of potash, as recommended by Sir Lauder Brunton (see *NATURE*, June 9, 1904, p. 141), continues, and lancets are distributed for this purpose, but the value of the results is discounted by the absence of identification of the snake that inflicted the bite. In Burmah nearly all the deaths occurred in paddy tracts where Russell's viper is particularly prevalent. Steps are being taken in that province to ensure a wide distribution of the Brunton lancets. It is reported that in the Pegu district six men and one buffalo bitten by Russell's vipers were operated on by headmen to whom lancets had been issued, and that all recovered but one man, who was unconscious before being